DEPTH OF FIELD FOR A CAMERA IN A MEDIA-EDITING APPLICATION

INCORPORATION BY REFERENCE; DISCLAIMER

[0001] Each of the following applications are hereby incorporated by reference: application Ser. No. 15/472,214 filed on Mar. 28, 2017; application Ser. No. 12/245,698, filed Oct. 3, 2008. The Applicant hereby rescinds any disclaimer of claim scope in the parent application(s) or the prosecution history thereof and advises the USPTO that the claims in this application may be broader than any claim in the parent application(s).

FIELD OF THE INVENTION

[0002] The invention is directed towards image and video rendering. Specifically, the invention is directed towards depth of field properties for cameras in applications that render images and/or videos.

BACKGROUND OF THE INVENTION

[0003] Digital graphic design, video editing, and media editing applications provide designers and artists with tools to create much of the media seen today through various media outlets (television, movies, Internet content, etc.). These tools allow designers the ability to generate, compose, composite, and animate images and videos in a virtual three-dimensional space.

[0004] A computer simulating the three-dimensional space is able to produce (i.e., render) an image of the space as seen from a particular point in the space, looking in a particular direction, with a particular field of view. Some applications define a virtual camera at the particular point that is oriented in the particular direction and has properties that define the particular field of view. Such a virtual camera can be moved around the three-dimensional space, re-oriented, and may have various other properties that can be adjusted. The virtual camera is a user-interface tool that collectively represents the set of properties that define the direction, angle of view, and other attributes for rendering a scene from a particular point of view in a particular direction.

[0005] Virtual cameras have generally been defined as having a particular focal plane, a distance at which objects will appear in focus when the view from the camera is rendered. However, users may desire the ability to move the apparent focal plane of the virtual camera closer to or further from the camera in the context of a scene laid out in a three-dimensional space within an application. Users may also want to be able to render in focus a range of distances and expand or contract this range within the context of a scene. Accordingly, there is a need in the art for virtual cameras with highly modifiable focal properties. Furthermore, there is a need for user interface tools to enable easy modification of these focal properties.

SUMMARY OF THE INVENTION

[0006] Some embodiments of the invention provide novel user interface tools for rendering a particular region in a media-editing application from a particular location, in a particular direction, within a particular field of view. The media-editing application of some embodiments provides a set of tools for a user to define a three-dimensional space that includes two- and three-dimensional media objects (e.g., images, text, video clips, and other such objects). This application further provides a set of user interface tools for viewing and controlling the focal properties for rendering a particular region within the created space from a particular location, in a particular direction, within a particular field of view.

[0007] This application further provides a user interface tool, referred to in the discussion below as a virtual camera, to represent the location, direction, etc. from which the space is rendered. The virtual camera of some embodiments has a region of focus that is a two-dimensional region (e.g., a plane) or three-dimensional region (e.g., a volume) within the region rendered by the virtual camera. In these embodiments, objects located in the region of focus are rendered in focus by the virtual camera while special effects (e.g., blurring effects, coloring effects, etc.) are applied to objects outside the region of focus but within the region rendered by the virtual camera.

[0008] Some embodiments provide novel tools for viewing and controlling focal properties of the virtual camera, which can render a region from a particular location, in a particular direction, within a particular field of view. In some embodiments, the modifiable focal properties include the size of the region of focus, its distance from the camera, and the amount of effects applied to objects not within the region of focus. Some embodiments display the region of focus within the three-dimensional space of the media-editing application, enabling a user to modify the region of focus of a virtual camera within the context of a scene rendered by the virtual camera.

[0009] Specific modifiable parameters in some embodiments are an aperture, a focus offset, a near focus, and a far focus. The aperture parameter of some embodiments enables a user to affect the extent to which special effects (e.g., blurring) are applied to objects not in the region of focus. The focus offset parameter of some embodiments allows a user to move the region of focus closer to or further from the virtual camera. The near focus and far focus parameters of some embodiments allow a user to modify the size of the region of focus such that objects are in focus at more than one distance. Some embodiments also allow modification of other focal properties.

[0010] Various embodiments provide various user interface tools, or combinations of user interface tools, for adjusting the depth of field parameters. Sliders are one example of a user interface tool for modifying the aperture, focus offset, near focus, and far focus, as well as other parameters. Another type of user interface tool is one that provides for direct numerical input of the parameters (e.g., as a number of pixels, a percentage, etc.), either in conjunction with sliders or separately. Some embodiments provide moveable planes within the three-dimensional space of the media-editing application representing the focus offset, near focus, and far focus.

[0011] In some embodiments, the planes that represent the focus offset, near focus, and far focus move whenever a user modifies the parameters with a slider, direct numerical input, or other user interface tool. In some embodiments, a user can select and drag the planes directly in order to modify the depth of field parameters. The planes have handles that are used for dragging the planes in some embodiments. Some embodiments provide only one of the described controls for modifying the depth of field parameters, while other